DOCUMENT RESUME

ED 466 458 SP 040 912

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TITLE Students' Perceptions of Types of Teacher's Controlling Behaviors Used during Learning Classroom Activities.
PUB DATE 2002-04-01
NOTE 17p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 1-5, 2002).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Classroom Techniques; Foreign Countries; Participative Decision Making; Secondary Education; Student Attitudes; Student Responsibility; *Teacher Behavior; Teacher Responsibility; *Teacher Role; *Teacher Student Relationship
IDENTIFIERS Netherlands

ABSTRACT

This study investigated the empirical structure underlying students' perceptions of their teachers' behaviors in terms of the amount of control displayed in the regulation of students' learning activities. A group of 2,061 Dutch secondary school students taught by 67 teachers completed a 14-item survey that examined their perceptions. Data analysis indicated that students distinguished between three types of teacher control. These included: strong teacher control, mainly consisting of teachers providing students with strategies to perform their learning activities; shared teacher control, emphasizing the sharing of responsibility between students and between students and teachers; and loose control, focusing on students' own decision making during the performance of learning activities. The shared control factor included items that referred to situations in which students were asked to work cooperatively as well as items that referred to situations in which students showed initiative during whole class situations. (Contains 32 references.) (SM)

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Students' Perceptions of Types of Teacher's Controlling Behaviors Used During Learning Classroom Activities

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Abstract

In this study student perceptions of the amount of control in their teachers' regulatory behavior during learning activities were investigated. In the literature a distinction is made between either two or three types of control. Some theorists distinguish between student-initiated and teacher-initiated regulation of students' learning activities, others between strong, shared and loose control of student learning. Multilevel confirmatory factor analyses (LISREL) were performed on perception data of 2061 secondary education students of 67 teachers. The outcomes provide support for a distinction with three types of control.

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Introduction

Currently, most scholars acknowledge that learning 'is not a passive, knowledge consuming and externally directed process, but an active, constructive and self-directed process in which learners build up internal knowledge representations that are personal interpretations of their learning experiences' (Vermunt & Verloop, 1999:258, following Bednar, Cunningham, Duffy & Perry, 1991). This conception of learning lies at the heart of constructivist theories. While constructivism has many and diverse 'faces' (Philips, 1995; Duffy & Cunningham, 1997)[1], few versions depart from the central assumption that learners are the constructors of their own knowledge, rather than passive receivers of information. This assumption is confirmed by research into learning that shows that the acquisition of knowledge and skills and the quality of the learning process are the effect of the mental activities of the learner, rather than the result of direct transference or absorption of the to-be-learned material (Brown, 1987; Shuell, 1988; Wang, Haertel & Walberg, 1993).

Following this assumption, *learning* is said to be a knowledge-construction process and will be defined here as 'the performance of mental activities by students that result in (relatively) stable changes in their mental or overt behavior or behavioral dispositions' (Vermunt, 1992; Boekaerts & Simons, 1995; Shuell, 1993; 1996). The mental activities undertaken to achieve these changes in behavior(al dispositions) are also referred to as *learning activities* (Shuell, 1996). While learning activities are always performed by students, teachers can undertake activities to *regulate* (i.e. initiate and maintain) the performance of learning activities by students (Vermunt & Verloop, 1999). In this line of reasoning, *teaching* can thus be described and defined in terms of the learning processes teachers aim their students to perform to achieve desired results. Whether students, however, will perform the (learning) activities teachers intend for them to complete may depend on the students' *perceptions of the quality of their teachers' regulatory behaviors*. We assume that students' perceptions of teacher behavior act as mediators between the regulating behavior of teachers and the actual performance of learning activities by the students. Students will only act on those behaviors of their teachers that they observe and interpret (perceive) in their personal idiosyncratic way. (e.g., Shuell, 1996). Two crucial variables that are assumed to determine the quality of teacher regulation are interpersonal teaching skills and clarity of instruction (den Brok, 2001). For instance, if teachers send vague nonverbal messages to students when giving instructions, lack authority in the classroom or provide unclear assignments or lesson structure, students will not likely successfully complete the intended learning activities, either because they do not comprehend what is expected from them, or because they anticipate acceptable consequences will result even if they don't complete the activities in the desired way.

Two dimensions seem particularly important in the whole range of possible and used teacher-regulatory actions: the *type of learning activity* that is targeted for students and the *amount of teacher*

control (den Brok, 2001; Brekelmans, Sleegers & Fraser, 2000; Vermunt & Verloop, 1999). Usually, three types of learning activities are discerned: cognitive, affective and regulative learning activities. Cognitive learning activities are aimed at processing information, affective learning activities at processing feelings and emotions that occur during learning; and regulative learning activities are aimed at planning, monitoring adjusting and evaluating particular cognitive and affective learning activities (den Brok, 2001; Vermunt & Verloop, 1999). While these qualitatively different learning activities probably form the core element in learning and its regulation by teachers, this aspect is not the focus of this paper. Here, attention is given to the second important element in teachers' regulation of learning activities: the amount of teacher control. More specifically, the attention is to students' perceptions of teacher acts that they interpret as being 'regulatory-' or 'control-'oriented.

Researchers disagree with respect to the different forms of control that can be exhibited in the regulation of learning activities. Most distinguish between three graduations of teacher control (e.g. Vermunt, 1992; Vermunt & Verloop, 1999; den Brok, 2001; Brekelmans, et al., 2000; Simons & de Jong, 1992): (a) *strong control*, or taking over/substituting the performance of learning activities from students; (b) *shared control*, or activating the students to take part in the performance of learning activities; and (c) *loose control*, or stimulating the students to perform learning activities by themselves as much as possible. For shared control, sometimes a further distinction is made between (a) *shared responsibility between student and teacher* and (b) *shared responsibility between student and student* (e.g. van Amelsvoort, 1999; Lamberigts, den Brok, Derksen & Bergen, 1999). Others (e.g., Shuell, 1993; 1996) distinguish between two traditional forms of control: *student-control* (i.e., student initiated control) and *teacher-control* (i.e., teacher initiated control).

Empirical evidence for these different distinctions is weak, as most such distinctions are primarily based on literature reviews or assumption-laden theoretical reasoning. Very little empirical data checking for the existence of such distinctions have been gathered from secondary-level students. If constructivist ideas (such as, students construct their own knowledge and perception of the learning situation) are taken seriously, then far more attention should be paid to students' perceptions of their teachers' behaviors within the context of classroom activities and expectations. In the study reported here, students' perceptions of control in teachers' regulation were investigated along with the kinds of (empirical) structures that seem to supports these perceptions.

Amount of perceived control in teachers' regulation of students' learning

As mentioned earlier, researchers disagree on distinctions among the various degrees of control in teachers' regulation of student learning as well as on the terms used to denote these degrees. In this section we describe in more detail some distinctions found in the literature.

According to Vermunt and Verloop (1999) all teaching methods can be placed on a dimension running from very strongly teacher-regulated to very loosely teacher-regulated. However, they single out three positions on this dimension: *strong*, *shared* and *loose* teacher control. In the case of *strong teacher control*, the teacher takes over or substitutes the major performances in completing targeted learning activities from students. Examples of this are teacher behaviors such as 'presenting an outline,' 'providing students with examples' and 'highlighting main points.' In each of these instances, the teacher does what students could and presumably should be doing. In the case of *loose teacher control*, the teacher assumes that students will perform the right learning activities on their own initiative and are able to perform and complete all the cognitive, affective and regulative learning activities by themselves. In these instances, the teacher allows students to operate freely and independently during learning activities on the assumption that students know what they are to do, are doing and are expected to do and are in fact doing all that is needed to complete the activities in an acceptable way. Some might refer to this as a form of extreme laissez faire overseeing of learning tasks by the teacher. With *shared control*, students are continually activated (either implicitly or explicitly) by their teacher to perform and complete targeted learning activities to some desired end.

Examples of this dimension of control are such teacher behaviors as asking questions, giving assignments or tasks and stimulating students to cooperate. Important for Vermunt and Verloop is that every student either has a high, intermediate or low level of skills in self-regulating their own learning, and that as a result of their individual ability to self-regulate their own learning, incongruence or friction between teacher and student regulation may occur. They posit that as the degree of incongruence increases, students are less likely to successfully complete the targeted learning activities. Greater congruence, on the other hand, leads to students who are more likely to be on task and to successfully complete these activities.

Brekelmans, Sleegers and Fraser (2000; following Simons & de Jong, 1992; Simons, 1992) make a similar distinction, but use different labels to denote them: *taking over*, *activating* and *stimulating*. *Taking over* refers to an instructional system in which the teacher initiates and fills in the learning activities of students. This happens, for instance, when a teacher makes a scheme of the lesson content on the blackboard and students have to copy this in their own papers. *Activating* refers to an instructional system in which students are forced to perform certain learning activities in a specified way assigned by the teacher. Building on the example of making the scheme, in such a system the teacher would ask students to make a scheme of the lesson content, following specific guidelines for contents and procedure. In this system, teacher and students share responsibility for the performance of learning activities. *Stimulating* refers to an instructional system in which students are stimulated to perform the learning activities. It concerns either the general advice to perform certain learning activities and leave out some other, or training students to perform the learning activities. In the scheme making example a teacher would just tell the students that when called upon, they should be able to provide him with the main points of the lesson content. Den Brok, while using the same distinction, calls the activating system, *shared control*, while Vermunt (1992) refers to it as *partial steering*.

Shuell (1996; 1993) only distinguishes between two degrees of teacher control in the regulation of learning activities. According to him, learning activities – while always being performed by the students – can be *initiated* by either the *teacher* (or other instructional agents, such as textbooks, computers, et cetera) or the *student*. He acknowledges, however, that in everyday school learning, there will always be a distribution of responsibilities between the teacher and student when it comes to initiating learning activities.

Most researchers conceptualize a very wide range of teacher control, including the extreme hypothetical polar positions on a continuum from total control by the teacher to total control and responsibility by the learner. In other words the actual degree of teacher control may fit anywhere along this continuum. Meanwhile, others focus mainly on the degrees of control possible between the two extremes. It is assumed that it is in the area between the polar positions, control is shared in different ways among the teacher and students (e.g., Lamberigts & Bergen, 2000; Lamberigts, et al., 1999; van Amelsvoort, 1999). This 'in-between' area of mixed control is referred to as '*activating instruction*' (van Amelsvoort, 1999; Lamberigts, et al., 1999) or '*teaching for active learning*.'

Although these constructs of control within the classroom include a range of meanings and conceptualizations, they all acknowledge that learning is not so much about the teacher presenting information and controlling the learning process, but about a shift of responsibilities from the teacher to students. Within popular conceptions of 'teaching for active learning,' a distinction is made between *teacher-led*, *student-led* and *co-student-led* control. In instances of *teacher-led control*, teachers model learning activities for the students and try to elicit the prior knowledge that is necessary for performing the learning activities. According to Lamberigts and Bergen (2000), teacher-led control is theoretically linked to ideas that can be found in cognitive constructivism, or highly teacher-centered methods, such as Direct Instruction (Rosenshine, 1978, 1983; Stahl, 1992). In instances of *co-student-led control*, teachers stimulate students to co-operate while completing the learning activities. Presumably this type of control is consistent with the theoretical assumptions of

optimal cooperative learning activities and activities aligned with the most social-oriented branches of constructivism. In the situation of *student-led control*, teachers stimulate the students to perform the learning activities by themselves as much as possible, leaving decisions to the students such as which activities to perform and in which order and the time needed to complete each part of each activity. This type of control is theoretically linked to radical-individualistic constructivism and to popular notions associated with the concept of 'powerful learning environments' (Lamberigts & Bergen, 2000).

While these notions of control are at least interesting if not entertaining from a theoretical point of view, these positions often do not address the matter of what students are in school to achieve rather than just to do. For instance, what exactly are teachers in the classroom expected and perhaps even hired and paid to do? If students are not engaging in appropriate thinking and task-completion behaviors, what is it that these theorists expect teachers to do? Perhaps of equal importance, who is it that determines what, how much and how well students are to learn? Few constructivist theories distinguish between the activities associated with constructing, processing and completing activities and actual learning. Furthermore, few of those who have addressed the issue of 'control' or 'regulation' by teacher and/or students have addressed the issue of the proper roles of the teacher when students are completing learning activities but not achieving or learning much. Hence, it is possible that teachers may set up situations that are very compatible with strong 'student control' and even student-centered and student-friendly powerful learning environments, and students spend their time and effort completing activities with very little actually learned.

In addition, the models and theories of 'control' and 'regulation' rarely distinguish between the two, much less make it clear what the roles of each are and where one ends and the other begins. For instance, while teachers may abdicate some of his or her control in the classroom situation to students; he or she is still responsible to help regulate what is done or not done by students as they try to complete learning activities. In these instances, teachers would be engaging in acts to facilitate students' thinking, acting and learning. At what point are constructivist teachers to total stop their faciliting activities to promote learning? If one were to accept positions that favor strong 'student control' for its own sake, then teachers are placed in the position of not interfering and of abdicating completely their facilitative roles in helping students during their constructing and processing activities. The discussions of 'control' above and students' perceptions of teacher control and regulatory behaviors that follows must be considered in light of these concerns.

Student perceptions of classroom control

If one accepts the constructivist claim that individuals construct their own, personal knowledge and view of reality, then each learner's perceptions relative to learning situations should be very important to teachers. According to Shuell (1996) "the manner in which the learner perceives, interprets and processes information in the instructional situation (including the content being learned and the social context in which the instruction occurs) is more important than the actions of the teacher in determining what the student will learn. [...] Ultimately, it is the perception of the student, not the intent of the teacher, that determines the effect that an instructional act has on the student's learning." (p. 734). When studying teacher regulation of student learning, student perceptions may prove to be of crucial importance and may provide a different vantagepoint for investigating the complex interaction between teacher and learner.

Students' evaluative perceptions of teacher behavior are different from teachers' perceptions of their own behavior and from perceptions by external observers. The first two are perceptions of participants from within the classroom context, often referred to as *beta-press*. Observations are usually done by participants from outside the classroom context, called *alpha-press* (Fraser, 1998). Research using teacher or external observer perceptions is rather common, while student perceptions are infrequently used (den Brok, 2001). Nevertheless, student perceptions have several advantages, on

top of the important theoretical reason described above (see Fraser, 1998, or den Brok, 2001). There are different types of student perceptions. One distinction has been made between the perceptions of actual or experienced teaching and the perceptions of preferred or ideal teaching (Fraser, 1998). A second distinction has been made between student perceptions of teaching with respect to the whole class in contrast to perceptions of teaching with respect to the student's own, personal roles in a learning situation or of the role of subgroups (McRobbie, Fisher & Wong, 1998). This study stresses student perceptions of actual teacher behavior with respect to the whole class.

Perceptions are formed during and result from every interaction between an individual and his or her environment (Fraser, 1998). Given this is the case, student perceptions of teacher behavior, in this case, their teacher's regulatory actions associated with different types of control, can be thought of as containing individual elements as well as elements that may be consistent with those of all other students in the same class. This distinction between individual and 'class' perceptions for the same teacher and teaching acts is important, because empirical data on student perceptions, such as used in this study, should examine both of these types of perceptions. This is especially so because the respondents are sampled at the same time as are all their classmates. In order to separate the shared perceptions from the personal, and to focus uniquely on the teacher-class level – reflecting the environment in which the behaviors occur, multilevel statistical techniques must be used.

Numerous studies on students' perceptions of teachers and the classroom environment have been conducted in the domain of learning environments research (Fraser, 1998). While many of these studies examined student perceptions in relation to other variables, only a small number investigated the empirical structure behind students' perceptions (e.g., den Brok, 2001; den Brok, Brekelmans, Wubbels, & Hox, submitted for publication). Most of these were carried out to investigate interpersonal teacher behavior (e.g., Wubbels & Brekelmans, 1998). Only a small number of all studies used the proper statistical techniques to account for the nested structure of the data (thereby acknowledging the social context in which individual perceptions are formed), such as multilevel structural equation modeling (Hox, 1995; Muthén, 1994).

Only a limited number of studies actually investigated students' perceptions of the type of control behaviors teachers used during learning activities. An Australian study (Taylor, Fisher & Fraser, 1997) used a questionnaire to evaluate the degree to which teachers used constructivist notions in their teaching. Their instrument, the Constructivist Learning Environment Survey (CLES), measured different elements of constructivism, including the amount of control and its sharing by teachers and students. Using factor analyses on individual and aggregated (class) student data, they made a distinction between 'shared control' by teachers and students and 'student negotiation' (a scale similar to the concept of student-led control or loose teacher regulation). Because their instrument did not include items referring to more teacher-centered behaviors, they could not distinguish a component indicating strong teacher control. A recent study in the Netherlands (den Brok, 2001) used an instrument with items referring to the type or degree of control in teacher regulation of learning activities. This study, while distinguishing between three forms of control (taking over, shared control and stimulating), found moderate to weak correlations between the three forms, both at the individual as well as the class (aggregated) level. This finding supported the idea that students apparently do distinguish between three types or degrees of control in teacher regulation. Another Dutch study (Lamberigts & Bergen, 2000; Lamberigts, et al., 1999), using student perception data at the individual level and employing structural equation modeling, found evidence for an empirical structure with three distinct forms of control within teaching for active learning: teacher-led, co-student-led and student-led. However, it was also found that all three forms could be subsumed under one larger factor, and that the last two forms of control were strongly related.

A major critique of all the studies mentioned above is that they did not employ statistical techniques that justified the multilevel structure of the data, even though some researchers studied the different levels separately. Aggregating (or disaggregating) data is not a solution and has important

disadvantages, because it may lead to spurious correlations or biased outcomes (Hox, 1995; den Brok, 2001). Moreover, the studies assumed a similar structure behind data at the individual and the class or teacher level. It has been shown that different (theoretical) structures may exist for different levels of perception data (e.g. den Brok, 2001; Hox, 1995). This seems logical, as a class's perceptions are computed as the average perception-score of all students in a particular class. Meanwhile, individual deviations in perceptions will occur in part because of differences in teacher treatment towards individuals, differences in norms and values held by individuals and differences in needs of individual students. The present study overcame these 'weaknesses' by using multilevel structural equation modeling to study students' perceptions.

Research question

The following research question was investigated:

What (empirical) structure underlies students' perceptions of teachers' behaviors in terms of the amount of control displayed in the regulation of students' learning activities?

Method

Sample

Questionnaire data from 2061 students, taught by 67 Secondary Education teachers in the southeastern part of the Netherlands, were used. The group consisted of 946 male students (45.9 percent) and 1,115 female students (54.1 percent). The majority of students (84.8 percent) were located in the upper half of Secondary Education: their age ranged between 15 and 18 years. A small percentage (12.7) of students were located in the first three grade levels of Secondary Education. Teachers of all subjects, physical education not included, participated. About one third of the teachers were female.

Instrument

Student perceptions of teacher regulation of students' learning activities was measured by a set of 14 Likert-like items that referred to the amount of teacher control in regulating classroom learning activities. The items were selected from a larger 33-item instrument that was aimed at mapping teachers' instructional behavior, the *Questionnaire on Teacher Instructional Behavior* (QIB) (Bergen, van Amelsvoort & Setz, 1994). The QIB was designed as a research instrument for mapping teacher behavior and is used as an evaluation instrument to obtain information on the effect of teacher training programs. The original questionnaire had four a-priori scales: two scales measuring more general basic teaching skills, namely (1) clarity in instruction and assignments and (2) control of classroom activities and students' learning processes, and two scales for the measuring of teaching for active learning, namely (3) teacher initiated regulation of student learning and (4) student initiated regulation of student learning. The reliability of these four original scales is satisfactory (Cronbachs' Alpha > .70).

The 14 items used in this study were selected by two of the authors (the first and second) based on face validity of their content. This is to say that each item was assumed to refer to a certain amount of teacher control in regulating student learning activities. These 14 items are displayed in Table 1. These items deal with different amounts of control in teacher regulation. Some items refer to providing strategies, providing an orientation on the lesson, or actively involving students in the lesson. Other items deal with stimulating cooperative learning, or independent performance of learning activities. Using a five-point Likert-like scale, students indicate their view of their teachers' regulatory activities. Item values vary from "1.0," revealing the students' perceive the indicated behavior is used "Hardly Ever," to "5.0," revealing the students' perceive the indicated behavior is

used "Very Often" by their respective teacher. In earlier research, the QIB displayed satisfactory reliability, both at the individual as well as at the aggregated (class) level (Bergen, et al., 1994; Lamberigts, et al., 1999; Lamberigts & Bergen, 2000).

Table 1 about here

Data Analyses

After initial selection on the basis of face validity, intra class correlation coefficients (ICC) were calculated using the SPLIT-2 program (Hox, 1995) in order to determine whether the items displayed enough variance at the teacher-class level, which was the level of interest in this study (see Table 1). Items with an ICC value of below 0.1 were excluded from further analyses (see den Brok, 2001). This was the case for items 12 and 30. Subsequent analyses were performed on the remaining 12 items.

The next step consisted of formulating and testing a number of multilevel structural equation models, using a procedure by Hox (1995) and Muthén (1994). Using the SPLIT-2 program, correlation matrices were computed for the individual and class level[2]. These matrices are reported in Table 2. Then, using the correlation matrix at the class level, an exploratory factor analysis was performed with SPSS, in order to obtain proper starting values for the structural equation models to be analyzed. Three factor analyses were performed, one with one factor, one with two and one with three factors. This was done, because earlier research either found one or three different amounts of control in teacher regulation (e.g., Lamberigts, et al., 1999; den Brok, 2001), or hypothesized the existence of two or three amounts of control (e.g., Vermunt & Verloop, 1999; Simons & de Jong, 1992; Brekelmans, et al., 2000; Taylor, et al., 1997; Shuell, 1996). Third, a number of confirmatory multilevel factor models (structural equation models) were formulated with LISREL. These models were tested with the multi-group option available in LISREL (see Hox, 1995; Jöreskog & Sörbom, 1989)[3]. For all of these models, no structure was formulated at the individual or student level, as the theories presented did not formulate models for the individual deviations of students from the shared class perception of teacher regulation. Therefore, a full factorial model (see Hox, 1995) was formulated at the student level. For the teacher-class level of the models, different structures were tested (see Table 2).

Tables 2 about here

For each model of Table 2, different model statistics were computed for model fit (e.g., Jöreskog & Sörbom, 1989), such as Chi-squared (with degrees of freedom and p-value), Goodness of Fit Index (GFI), Root Mean Square Residual (RMR) and Standardized Root Mean Square Residual (SRMR). When two models showed equal or near-equal fit, the most economical model (i.e., the model with the least number of relationships specified) was chosen. Analyses for each model started out with the starting values computed in the exploratory factor analyses as fixed values. Next, item loadings were freed until no further fit improvement could be reached.

Results

To see whether students made (a) no distinctions between different amounts of teacher control in regulation, (b) distinctions between teacher-initiated and student initiated regulation, or (c) distinctions between three different types of teacher control (i.e., "strong," "shared" or "loose" control), fit for each model in Table 2 were computed. The fit for each model is presented in Table 3. As reported in Table 3, the data do not support a model with only one factor or amount of control.

While model fit for models with two factors, teacher-initiated regulation and student-initiated regulation, was better, it was still not satisfactory. A three-factor model best fit the data. Because fit is nearly similar for a model with three uncorrelated factors as compared to a model with three correlated factors, the simpler and more economic model with uncorrelated factors was selected (model 3a). With a non-significant *p*-value of the chi squared, a GFI that reached the prescribed value of .90 and RMR values close to .05, fit of this model was satisfactory. This meant that three distinct types of control seemed to underlie students' perceptions of teacher regulation.

Table 3 about here

In order to interpret the content of the factors of model 3a, further inspection of the factor loadings is necessary. These factor loadings are displayed in Table 4. The five items that loaded most strongly on the first factor were 's/he stimulates us to help each other when working on assignments.' 's/he lets us think in small groups on how to work on assignments.' 's/he appreciates it when we take initiatives' and 's/he stimulates us to discuss the result of our work with other students.' All of these items either pertained to situations where students either shared control with other students or with the teacher. This factor was labeled *shared control*. Three items loaded strongly on the second factor: 's/he provides strategies for learning for a test.' 's/he provides strategies for making homework' and 'during the lesson, s/he provides strategies on how to plan for school work.' These items all referred to regulation with *strong* teacher *control*. Finally, three items loaded strongly on the last factor: 's/he lets us decide by ourselves at what pace to work on an assignment.' 'in his/her lesson we can decide by ourselves how to work on assignments' and 'in his/her lessons you can plan your work independently.' Because all items referred to regulation with a strong role for the student and a weak role for the teacher, this factor was regarded as the *loose control* factor. One item is associated with two factors at the same time, namely 'when we work together, s/he stimulates that we take responsibility for each other.' Apparently, in the perception of students, this type of regulation behavior includes both elements of shared control as well as strong control by the teacher. Perhaps, it is not common for students to share responsibility, unless asked or stimulated by the teacher.

Table 4 about here

While model 3a shows satisfying overall fit, the three factors do explain different amounts of variance in the items. In Table 5 percentages of variance explained by the model for each of the twelve items are reported. As shown, the percentages explained range between 2 and 14 percent. The largest variance was explained for the item, 's/he provides strategies on how to plan for school work,' while the least variance was explained for the item, 's/he lets us decide by ourselves in what pace we work on an assignment.' The percentages of variance seemed rather low. However, this was not surprising, as most of the variance in the items was located at the student level (see ICC in Table 1), and no model was specified for this level. Moreover, it seemed likely that more factors, other than control in teacher regulation, underlie the answers on each of the items.

Table 5 about here

Discussion

In this study the empirical structure behind students' perceptions of teacher control in the regulation of learning activities was investigated. The literature suggested either a model that distinguished between three types of control (strong, shared and loose), two types of control (teacher-initiated and student-initiated) or no distinctions in control. The outcomes of this study support the distinction between three particular types of teacher control as determined by students' perceptions of their teachers' regulatory behaviors. These three types closely resemble similar distinctions made in the literature. Within the set of items studied, students distinguished between *strong teacher control*, mainly consisting of teachers providing students with strategies to perform their learning activities, *shared teacher control*, emphasizing sharing of responsibility between students and between student and teacher, and *loose control*, focusing on students own decision making during the performance of learning activities. The *shared control* factor included items that referred to situations in which students were asked to work cooperatively as well as items that referred to situations in which students showed initiative during whole class situations.

While these results provide a clear and promising picture, a number of avenues remain open for further study. First, the structure in students' perceptions may well have been influenced by item formulation. Post study examination revealed that many of the items ending up in the same factors showed considerable similarity in formulation and language. A good example of this can be found in the set of items in the *strong control* factor, which were all written with the opening phrase of "s/he provides strategies for...." If this identical opening phrase prompted students to answer in a similar manner, the structure found may be partially due to the instrument, rather than due to actual or theoretical distinctions made by students. Second, the study included only 12 items, which is a rather limited number. On the one hand, one may strive for more items and an even wider range in the types of control in order to see if the structure holds. On the other hand, by introducing more items (and possibly more factors) model estimation becomes a more complex task. Unfortunately, our situation restricted us to models with a maximum of 20 items. Moreover, the bank of items we could use only partially related to control in teacher regulation. Nevertheless, because of these two reasons, further research with the instrument and a larger pool of items are necessary. In this respect, the outcomes of this study can be regarded as preliminary and at the same time promising, because even a set of 12 items seems to be able to provide a sound empirical basis for the theoretical structure proposed in most of the literature. Whether the results of future studies using a larger pool of items will generate identical results are unknown.

Third, the results of this study are uniquely based on student perceptions. While valuable, we have no data as to whether similar structures can be found for teacher perceptions, teacher and student perceptions of ideal teaching or perceptions of observers. Far too little quality research has been done in these areas. Given the literature, a similar, if not identical, three-part structure is assumed for the perceptions of teachers and students (e.g. den Brok, 2001).

Fourth, no model was specified for individual level, because currently no theory exists for this level. This means that in the future time should be devoted to theorizing and investigating the reasons why individual student perceptions on the type of control in teacher regulatory actions may differ from perceptions shared by an entire class. Are different students treated differently? Do all students experience the same types of control in particular teacher regulation behavior? Do students have different needs with respect to the amount of teacher regulation they need? Such investigations should include the use of interviews with students and teachers, as well as observations.

Fifth, the outcomes of this study appear to be useful for everyday practice. They may help teachers and teacher trainers to note indicators of students' perceptions and subsequent reactions to the regulatory behaviors being displayed. Teachers may then use their observations to consider how their regulatory behaviors may be altered in the direction of more student responsibility and control of their

learning actions. However, this last point must be considered in light of one's definition of teaching, 'good' teaching and 'effective' teaching. Until these definitions are constructed and justified, then it will be difficult for teachers to determine at any particular moment which of the three types of regulatory behaviors are appropriate.

Finally, while the data strengthened certain theoretical assumptions used to guide this study, perhaps another set of concepts and assumptions should be considered. The study focused more on cognitive constructivist assumptions. Socio-constructivist assumptions might provide valuable supplements to the framework. Also, the study assumed that students are (usually) willing and self-inclined to learn in the classroom, while this might not always be the case (e.g. Meyers, Casteel & Stahl, submitted). Therefore, in some instances the teacher may be controlling student behavior, rather than students' learning activities. This means, in the future, efforts investigating structures in students' perceptions of teaching should be broadened to other teacher behaviors and concepts.

Notes

1 Cunningham & Duffy (1997) distinguish between cognitive constructivist theories and socio constructivist theories. Others make similar distinctions. Philips (1995), for example, claims that constructivist theories differ on two dimensions, one being the distinction between individual and public, the other being the distinction between nature as something given and constraining (instructing) the learner or nature as something changeable by the creating spirit of humans. This paper uses ideas from several constructivist theories, although emphasis lays on cognitive constructivism.

2 The SPLIT-2 program computes an aggregated correlation matrix for the teacher-class level, and a deviation matrix at the individual or student level. At the individual level, the matrix represents correlations between deviation scores of the student from the aggregated class mean. Furthermore, the program provides additional statistics, such as intra class correlation coefficients for the variables analyzed, as well as a constant that is necessary for scaling between the two levels in the analyses.

3 Multilevel models can be formulated within LISREL by using the multigroup option. In this option two groups (data sets) are distinguished, for one group a model at the individual level is formulated, for the other group a complete model (both individual and class level model) is formulated. The groups use the correlation matrices computed by the SPLIT-2 software as input data.

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Appendix A

SPLIT 2 correlation matrix of the selected items (individual level above diagonal, class level below diagonal.

	It3	It4	It7	It9	It11	It13	It16	It21	It22	It25	It26	It33
It3	1	.216	.229	.255	.328	.204	.114	.361	.242	.087	.353	.197
It4	.533	1	.236	.289	.245	.247	.078	.186	.200	.134	.171	.183
It7	.486	.417	1	.504	.261	.415	.071	.236	.186	.099	.225	.186
It9	.521	.424	.847	1	.336	.526	.092	.266	.170	.108	.238	.195
It11	.548	.485	.345	.262	1	.288	.113	.302	.228	.133	.311	.194
It13	.485	.281	.711	.752	.393	1	.080	.229	.129	.094	.237	.156
It16	.102	-.028	-.113	-.214	.100	-.100	1	.099	.190	.280	.118	.340
It21	.741	.454	.605	.660	.511	.639	-.139	1	.294	.084	.283	.171
It22	.572	.327	.372	.307	.525	.323	.333	.495	1	.132	.216	.216
It25	.275	.150	.064	.119	.074	.049	.513	.048	.185	1	.174	.401
It26	.763	.345	.404	.385	.602	.492	.051	.628	.515	.179	1	.191
It33	.443	.269	.238	.257	.125	.219	.563	.264	.446	.763	.282	1

Table 1

Items for control in teacher regulation that have been used in the analyses (displayed in order of amount of control from strong to loose) and intra class correlation (ICC).

Items	ICC
4. S/he makes clear at the beginning of the lesson what will happen during that lesson.	.24
12. At the end of the lesson s/he repeats the most important points.	.08
7. S/he provides strategies for learning for a test.	.22
9. S/he provides strategies for making homework.	.22
13. During the lesson s/he provides strategies on how to plan for school work.	.16
30. S/he stimulates that we take responsibility for our work.	.06
22. S/he appreciates when we show initiative.	.12
3. S/he stimulates us to help each other when working on assignments.	.23
11. S/he lets us think in small groups on how to work on a certain assignment.	.12
21. When we work together, s/he stimulates us to take responsibility for each other.	.15
26. S/he stimulates us to discuss the results of our work with other students.	.22
25. S/he lets us decide by ourselves at what pace to work on an assignment.	.12
16. In his/her lesson we can decide by ourselves how to work on assignments.	.11
33. In his/her lessons you can plan your work independently.	.14

Table 2

Structures tested at the teacher-class level parts of the multilevel factor models.

Model	Structure
Model 1	Model with one factor, not distinguishing between different amounts of control in teacher regulation. All items load on one and the same factor.
Model 2a	Model with two uncorrelated factors, distinguishing between teacher-initiated regulation and student-initiated regulation. All items load on both factors.
Model 2b	Similar model as model 2a, but correlations (psi) allowed between the factors.
Model 3a	Model with 3 uncorrelated factors, distinguishing between three different amounts of control (strong, shared, loose). All items load on all three factors.
Model 3b	Similar model as model 3a, but correlations (psi) allowed between the factors.

Table 3

LISREL model fit statistics of different multilevel structural equation models.

Model	Chi-squared/DF/ p-value	GFI	RMR	SRMR
Model 1	102.50 / 64 / .0016	.81	.18	.15
Model 2a	66.71 / 55 / .13	.87	.13	.11
Model 2b	66.59 / 54 / .12	.87	.12	.11
Model 3a	51.37 / 60 / .88	.90	.067	.062
Model 3b	51.29 / 57 / .81	.90	.063	.067

Table 4

Estimated factor loadings (standardized) in model 3a for each of the selected items (freely estimated factor loadings are indicated with an asterisk).

Item	Factor 1	Factor 2	Factor 3
3	.76	.38	.20
4	.61	.26	-
7	.27	.87	-
9	.23	.93	-
11	.83	-	-
13	.31	.80	-
16	-	-.57 *	.87
21	.64	.58	-
22	.69	-	.33
25	-	-	.84
26	.77	.26	-
33	.17 *	.30	1.00 *

Table 5

Percentages of variance explained by model 3a in each of the items.

Item	Percentage explained	Item	Percentage explained
It3	5	It16	9
It4	3	It21	4
It7	7	It22	8
It9	12	It25	2
It11	7	It26	6
It13	14	It33	6

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